



Bison IV Operating, LLC

TOPSOIL PROTECTION PLAN

FOR

Boomhog 8-59 3

Prepared For:



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Denver, CO 80203
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Prepared By:



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Date Prepared: July 2023

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1. INTRODUCTION

This Topsoil Protection Plan (Plan) was prepared by RPG Resources, LLC (RPG) to support Bison IV Operating, LLC (hereafter Bison or the Operator) in preparing Form 2A to permit the development of the Boomhog 8-59 3 development.

The intent of this plan is to provide site-specific guidance and recommended best management practices (BMPs) for topsoil management throughout the construction and interim reclamation project phases. The Operator has developed this plan to comply with federal, state, and local criteria and guidelines, as they relate to topsoil management. The following procedures will be implemented to ensure protection of soils through all oil and gas exploration and production phases.

2. SITE DESCRIPTION

2.1. General

The Boomhog 8-59 3 Pad will be located entirely within privately owned property in Township 8N, Range 59W, Section 3 in Weld County, Colorado. For the purposes of this plan, the limit of disturbance refers to the development of an oil and gas location and is hereafter referred to as the Site.

2.2. Topography and Land use

The Site slopes to the northeast at a 1-2% grade. The Site is located on grassland, classified for the purposes of this plan as rangeland. The Site is located within the Western Great Plains Range and Irrigated Region Land Resource Region (LRR) of the Central High Plains, southern part Major Land Resource Region (MLRA).

2.3. Natural Features

There are no National Hydrography Dataset (NHD) stream features or National Wetland Inventory (NWI) wetland features mapped within 500 feet of the proposed oil and gas location. No unmapped wetlands or waterways were identified at the time of the field survey. Stormwater best management practices (BMPs) will be installed prior to initiating construction, as necessary. Impacts to wetlands or waterways are not anticipated as a part of this development.

3. FIELD OBSERVATIONS

3.1. Methodology

Topsoil depth was evaluated using physical and morphological soil characteristics. As described below, eleven (11) soil test pits, each measuring approximately 36 inches in total depth, were evaluated across the proposed disturbance area for the Site (see Appendix B). Soil colors were evaluated using a Munsell Soil Color Book. Two (2) of the eleven (11) test pit locations had soil samples collected within the proposed topsoil salvage depths. Soil samples were submitted to Weld Laboratories in Greeley, CO for analysis of baseline agronomic soil properties. The results will be used to apply topsoil reclamation amendments as needed. See Appendix A for laboratory results.

3.2. Soil Physical & Morphological Characteristics

One soil type was identified by the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Web Soil Survey (WSS): Ascalon fine sandy loam, 0-6% slopes (4). Naming conventions of the test pits discussed within the subsections below refer to the WSS map symbology.

Ascalon fine sandy loam, 0-6% slopes (4) covers approximately 15.00 acres of land within the proposed disturbance area, and 11 test pits were dug within the mapped limits of soil type 4.

3.3. Conclusions

Observed topsoil color was recorded as 10YR 5/2, and topsoil texture was recorded as silty clay loam. Based on the observed soil characteristics, such as color, texture, and level of organic matter, we recommend salvaging approximately 12 inches of topsoil across the Site.

4. OPERATIONAL PHASES

4.1. Construction Activities

4.1.1. Soil Removal and Segregation

During all excavation activities on Site, the Operator shall separate and store the topsoil horizon as defined above, and mark or document stockpile locations to facilitate subsequent reclamation. When separating the soil horizons, the Operator shall segregate the horizon based upon noted changes in physical characteristics such as organic content, color, texture, density, or consistency.

4.1.2. Horizons Too Rocky or Too Thin

This Site is not expected to have rocky soil horizons within any of the proposed excavation areas. However, if encountered, the Operator shall use best practices to properly segregate and store the topsoil to the extent practicable.

Too rocky shall mean that the soil horizon consists of greater than thirty-five percent (35%) by volume rock fragments larger than ten (10) inches in diameter. Too thin shall mean soil horizons that are less than six (6) inches in thickness. The Operator shall segregate remaining soils to the extent practical to a depth of three (3) feet below the ground surface or bedrock, whichever is shallower, based upon noted changes in physical characteristics such as color, texture, density or consistency and such soils shall be stockpiled to avoid loss and mixing with other soils.

It is anticipated that topsoil will be stockpiled on location for a duration greater than 30 days. All stockpiled topsoil shall be stabilized as soon as possible, but no later than 14 days after completion of construction activities. All topsoil stockpiles will be drill seeded and mulched using a certified weed free mixture or similar hydroseeding application with binding agent to ensure seed takes to soil. Surface roughening should occur prior to seeding to assist the holding seed/mulch and or hydroseed, particularly after rain events.

Approximately 681,021 cubic feet (25,223 cubic yards) of total topsoil will be segregated and stockpiled along the northern edge of the pad. The stockpile will measure approximately 15 feet in height and be staged at a ratio of 3:1.

4.2. Drilling and Completions

4.2.1. Protection of Soils

All stockpiled soils shall be protected from degradation due to contamination, compaction and, to the extent practical, from wind and water erosion during drilling and production operations. BMPs to prevent weed establishment and to maintain soil microbial activity shall be implemented.

4.2.2. Weed Management

During normal operations and stormwater inspections, Bison employees and contractors will monitor the stockpile for erosion and establishment of undesirable and noxious weeds. Weeds will be treated mechanically with a mower whenever plant height exceeds 6 inches or before seed development. Chemical treatment of weeds with broad-leaf herbicides will only occur in spot-specific situations where prostrate weed growth or other site conditions preventing mechanical treatment are encountered. Soil sterilant and non-selective herbicides will not be used.

4.2.3. Maintenance & Repairs

Any identified erosion will be repaired as soon as practical, typically within 72 hours. Additional stormwater control measures will be deployed as needed. All deployed temporary stormwater control measures will be maintained and will remain in place until the disturbance achieves final stabilization as defined in the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division COR400000 permit.

4.3. Interim Reclamation

When the Site enters the production phase of operations, areas no longer in use, totaling approximately 4.4 acres, will be interim reclaimed. At least twelve (12) inches of topsoil will be redistributed throughout the interim reclamation area and contoured to match pre-disturbance topography. The redistributed soils will be tilled to adequately prepare the seedbed for seeding operations. Approximately 184,437 cubic feet (6,831 cubic yards) of total topsoil will be used during the interim reclamation phase.

5. MONITORING & INSPECTIONS

5.1. Stockpile Management

Prior to the stockpile being adequately stabilized, perimeter sediment BMPs should be utilized to minimize any topsoil migration off Site due to a rain event. Perimeter BMPs can be removed after stabilization is achieved. Once vegetative cover begins to grow in, the stockpile should be mowed periodically to help promote even vegetative growth. Weeds should be removed if present. Soil sampling and chemical or mechanical remedies such as pH additives or aeration, respectively, may be needed if grass growth is not achieved during the growing season. Additional seeding might also be required to achieve widespread coverage.

5.2. Inspections

Inspection of BMPs shall occur for as long as they remain installed onsite. As per the CDPHE guidance, over the course of active construction, inspection shall occur every seven (7) days; or every fourteen (14) days with post-storm inspections completed within 24 hours of precipitation accumulation or snow melt.

When the construction Site is considered idle, routine inspections must be performed minimally every 14 days and within 72 hours following storm events. When construction is complete and the Site is awaiting vegetative growth, inspections shall be conducted once every 30 days. Post-storm inspections are not required during this phase of construction. During all inspections, necessary repairs to BMPs will be noted and corrective actions shall be immediately implemented. If noted deficiencies cannot be immediately addressed, the reasoning shall be noted, and repairs will be scheduled.

Topsoil will continue to be monitored during 30-day stormwater inspections. Inspections will not cease until the disturbance area meets 80% of reference area vegetative cover specified for achieving final stabilization under applicable stormwater CDPHE stormwater permit requirements. Topsoil protection, weed management, and erosion control/repair will continue throughout the life of the Location per Colorado Energy and Carbon Management Commission (ECMC) 1000 Series Rules.

6. SITE-SPECIFIC BMPS

Each of the BMPs listed below are intended for use at this Site specifically (see Topsoil Protection Plan Exhibit in Appendix B). These BMPs are also consistent with the field-wide Stormwater Management Plan (SWMP) for Bison.

- Stockpile Management
 - Topsoil will be stockpiled along the northern edge of the proposed pad. In order to mitigate topsoil loss and migration of soil offsite, the stockpile will undergo surface roughening, seeding, and mulching.
- Surface Roughening
 - Once topsoil segregation and stockpiling are complete, the stockpile surface will undergo surface roughening. A tracked vehicle will drive over the surface in order to imprint horizontal ridges to encourage sediment entrapment, improve infiltration, and reduce runoff velocity.
- Seeding
 - Once topsoil segregation, stockpiling, and surface roughening are complete, the stockpile will be seeded to mitigate erosion. Establishing vegetative cover will help to stabilize the soil, reduce wind and water erosion, minimize rill erosion, and reduce overall surface runoff. The stockpile will be regularly monitored for noxious weed growth. Re-seeding will occur as necessary, over the course of active construction to achieve widespread uniform vegetative cover.
- Mulching
 - Post seeding: a layer of straw or hay mulch will be installed via crimping along the stockpile in order to promote seed germination and further stabilization of the soil. Mulching helps to mitigate the impacts of rainfall and increase soil moisture retention. Mulching will be monitored and re-applied as necessary until vegetative growth is established.

APPENDIX A

Soil Sample Results and Photos

WELD LABORATORIES, INC.

1527 First Avenue • Greeley, Colorado 80631
Phone: (970) 353-8118 • Fax: (970) 353-1671
www.weldlabs.com

September 20, 2022

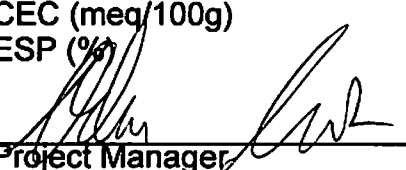
RPG Resources

Attn: Russell Beam

1313 Ben Nevis Ave

Broomfield, CO 80020

Laboratory No. Sample ID	E22217-5A Boomhog 4-1	Extraction Method
Sodium (ppm)	19.25	Saturated Paste
Calcium (ppm)	79.45	
Magnesium (ppm)	17.35	
pH	7.14	
EC (mS/cm)	0.66	
Saturated Paste %	65.40	
SAR	0.51	
Nitrate-N (ppm)	2.20	AB-DPTA
Phosphorus (ppm)	1.12	
Potassium (ppm)	1151.3	
Copper (ppm)	2.77	
Iron (ppm)	14.2	
Manganese (ppm)	2.9	
Zinc (ppm)	0.7	
Ammonia-N (ppm)	9.7	KCl Water
Chloride (ppm)	10.4	
Boron (ppm)	0.4	
Sand (%)	26.2	
Fine Sand (%)	6.1	
Silt (%)	28.9	
Clay (%)	38.8	
Classification	CLAY LOAM	
Organic Matter (%)	1.7	Walkley-Black
% CaCO ₃ -C equivalent	3.00	
CEC (meq/100g)	43.77	
ESP (%)	0.19	


Project Manager

9-20-22
Date

WELD LABORATORIES, INC.

1527 First Avenue • Greeley, Colorado 80631

Phone: (970) 353-8118 • Fax: (970) 353-1671

www.weldlabs.com

September 20, 2022

RPG Resources

Attn: Russell Beam

1313 Ben Nevis Ave

Broomfield, CO 80020

Laboratory No. Sample ID	E22217-5B Boomhog 4-3	Extraction Method
Sodium (ppm)	12.25	Saturated Paste
Calcium (ppm)	56.2	
Magnesium (ppm)	18.65	
pH	6.42	
EC (mS/cm)	0.547	
Saturated Paste %	47.80	
SAR	0.36	
Nitrate-N (ppm)	12.41	AB-DPTA
Phosphorus (ppm)	3.80	
Potassium (ppm)	824.6	
Copper (ppm)	1.53	
Iron (ppm)	16.9	
Manganese (ppm)	8.1	
Zinc (ppm)	0.4	
Ammonia-N (ppm)	9.9	KCl Water
Chloride (ppm)	17.2	
Boron (ppm)	0.2	
Sand (%)	28.1	
Fine Sand (%)	7.8	
Silt (%)	28.9	
Clay (%)	35.2	
Classification	CLAY LOAM	
Organic Matter (%)	2.7	Walkley-Black
% CaCO ₃ -C equivalent	7.16	
CEC (meq/100g)	28.82	
ESP (%)	0.18	


Project Manager

9-22-22
Date

PHOTOS



1. Boo-4-010 Soil Test Pit Location.



2. BOO-4-011 Soil Test Pit Location.

PHOTOS



3. BOO-4-012 Soil Test Pit Location.



4. BOO-4-013 Soil Test Pit Location.

PHOTOS



5. BOO-4-014 Soil Test Pit Location.

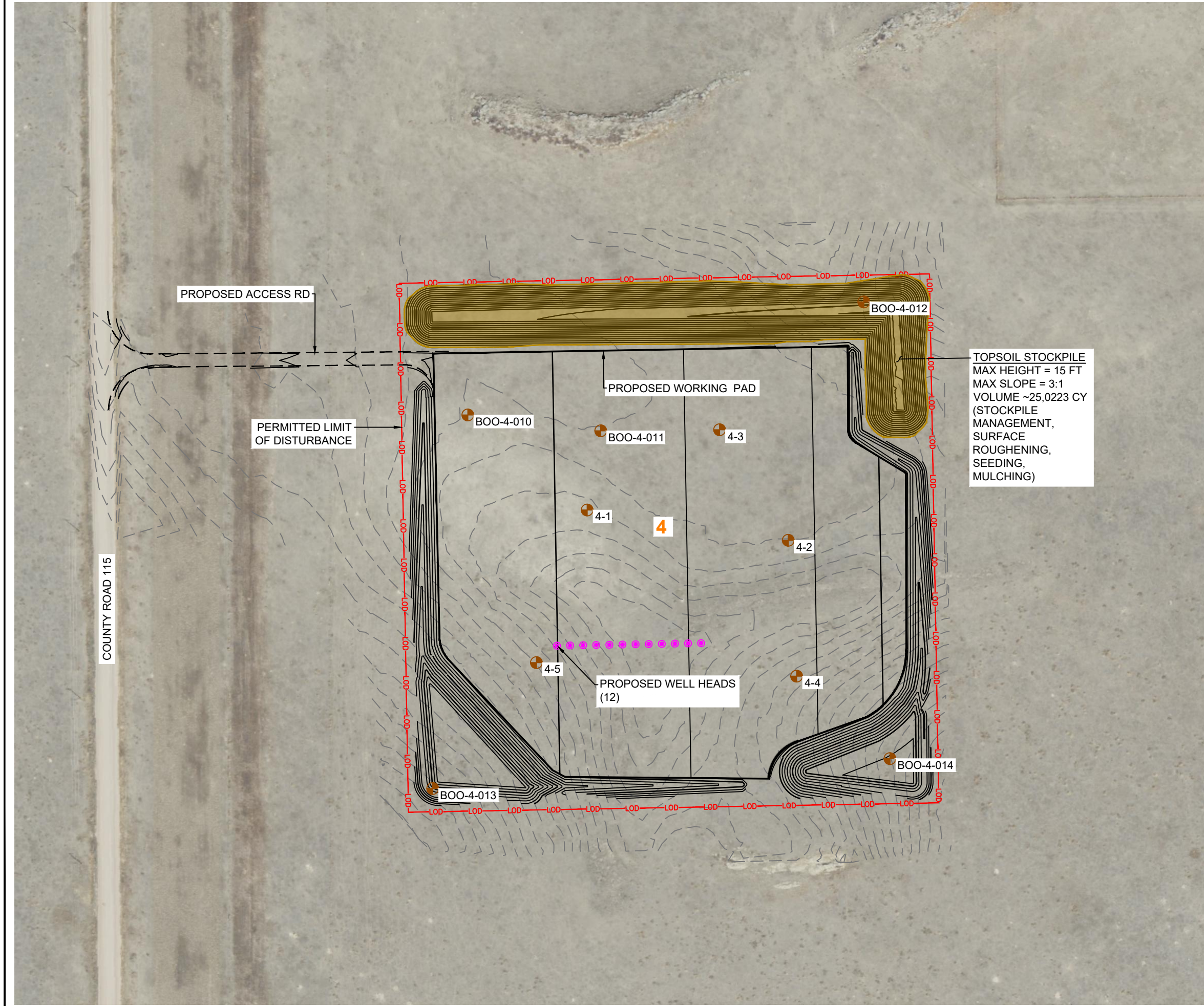
APPENDIX B

Topsoil Protection Plan Exhibit

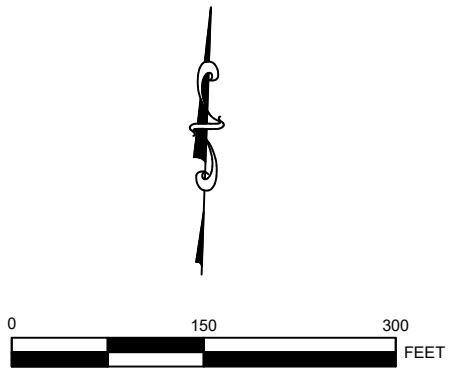
MAP UNIT SYMBOL	MAP UNIT NAME	RATING	ACRES IN AOI	PERCENTAGE OF AOI
4	ASCALON FINE SANDY LOAM, 0-6% SLOPES	N/A	15.00	100.0%
TOTALS FOR AREA OF INTEREST			15.00	100%

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED WORKING PAD
- ACCESS ROAD
- LOD — LOD — LOD PERMITTED LIMIT OF DISTURBANCE
- PROPOSED WELL HEAD
- ▭ PROPOSED TOPSOIL STOCKPILE
- SOIL UNIT BOUNDARY
- 4 SOIL UNIT SYMBOL
- SOIL SAMPLE LOCATION



TOPSOIL STOCKPILE
 MAX HEIGHT = 15 FT
 MAX SLOPE = 3:1
 VOLUME ~25,0223 CY
 (STOCKPILE MANAGEMENT, SURFACE ROUGHENING, SEEDING, MULCHING)



BISON IV OPERATING LLC	
DATE PREPARED: JULY 2023	
BOOMHOG 8-59 3 PAD	
TOPSOIL MANAGEMENT PLAN EXHIBIT	1 OF 1

APPENDIX C
BMP Datasheets

29. Stockpile Management (SM)



1. DESCRIPTION:

Stockpile areas are used for temporary storage of construction materials and must be managed to minimize erosion and sediment transport from erodible material stockpiles.

2. CONTROL MEASURE USES

- Erosion Control
- Sediment Control
- Site/Materials Management

3. RELEVANT SPECIFICATION SECTIONS

[Section 208](#) - Erosion Control

- a) **208.07** - Stockpile Management

4. RELEVANT M-STANDARD DETAILS

No Standard Details exist for this Management Strategy.

5. BASIS OF PAYMENT

Pay item	Description	Pay Unit
208-00028	Plastic Sheeting	SY
213	Mulching	VARIES
208	Various items to contain perimeter	

6. APPLICATIONS

Areas where active and nonactive stockpiles of construction materials are stored.

7. LIMITATIONS

- Stockpiles should not be placed on paved areas unless no other practical alternative exists on-site.

8. APPROVED PRODUCTS LIST

Refer to: <https://www.codot.gov/business/apl>



Erosion Logs used for stockpile management practices

9. PROCEDURES

- Stockpiles should be placed a minimum of 50 feet away from State Waters and shall be confined so that no potential pollutants will enter State Waters and other sensitive areas. Stockpiles shall also be protected with a temporary perimeter control measure. Level-to-gently-sloping grassed areas provide good stockpile sites and should not be placed in or along wetlands, ditches, swales, or against slopes that are more than 2:1.
- Stockpiling of contaminated soils should be avoided. If unavoidable, these stockpiles should be covered with plastic sheeting with berms surrounding the stockpile to prevent runoff from leaving the construction site. Contaminated soils should be transported offsite.
- Implement wind erosion control practices in accordance with Wind Erosion Control (fact sheet No. 38) as appropriate on all stockpiles.
- Erodible stockpiles (including topsoil) must be contained with an acceptable control measure at the toe (within 5 to 10 feet of the toe) at all times

29. Stockpile Management (SM)



10. PROTECTION OF STOCKPILES FOR PROJECTS TEMPORARILY HALTED FOR 14 DAYS

- Soil Stockpiles:
 - Soil stockpiles should be covered or protected with interim stabilization in accordance with 208.04(e). If no longer needed, the stockpiles should be removed and disposed of properly.
- Stockpiles of aggregate base, or aggregate subbase:
 - These stockpiles should be covered or protected with a perimeter sediment barrier at all times. If no longer needed, the stockpiles should be removed and disposed of properly.
- Stockpiles of “cold mix”:
 - Cold mix stockpiles should be placed on and covered with plastic sheeting material at all times and surrounded by a berm.
- Stockpiles/storage of pressure treated wood with copper chromium and arsenic or ammonia, copper, zinc, and arsenate:
 - Treated wood should be covered with plastic sheeting material at all times and placed on pallets.
 - Along with plastic sheeting material, tarps can be used to cover unused materials and materials on pallets.

11. PROTECTION OF ACTIVE STOCKPILES

- Prior to the onset of precipitation, active stockpiles of the identified material should be protected further, as follows:
 - All stockpiles require temporary stabilization at the end of each day in accordance with 2018.04(e), and require a sediment barrier, such as Erosion Logs, Silt Fence, or Compacted Berms.
 - Stockpiles of cold mix should be placed on and covered with plastic sheeting material.

12. MAINTENANCE AND REMOVAL

- Routinely spot-check stockpile areas for compliance. Repair perimeter control and covers as needed. Sediment should be removed when sediment accumulation reaches half of the barrier height.
- Inspect containment structures or other perimeter controls routinely and repair when signs of degradation are visible.
- Remove stockpiles and dispose of properly if no longer needed.
- Re-vegetate or install other approved methods of final stabilization in areas where stockpiles and access roads are located.

6. Surface Roughening and Vertical Tracking (SR)

1. DESCRIPTION:

Surface Roughening and Vertical Tracking (also referred to a temporary stabilization) are control measure practices that manipulate the subsoil by either creating different textures over the unfinished grade or using a tracked vehicle to drive over the surface, creating horizontal grooves and ridges. Surface roughening texture to the soil surface will reduce runoff velocity, encourage infiltration, and trap sediment..

2. CONTROL MEASURE OBJECTIVES

- Erosion Control
- Sediment Control
- Site/Materials Management

3. RELEVANT SPECIFICATION SECTIONS

[Section 208](#) - Erosion Control

- a) 208.04 (e).1 - Temporary Stabilization
- b) 208.05 (s)/(t) - Construction of Control Measures

4. RELEVANT M-STANDARD DETAILS

Section not applicable for this control measure.

5. BASIS OF PAYMENT

Not measured or paid for separately but shall be included in the work.

6. APPLICATIONS

- Used to temporarily stabilize disturbed areas during construction and prior to final stabilization activities.
- Used along disturbed slopes, temporary stockpiles, sediment basins, and/or compacted soil diversion berms.



Vertical tracking on disturbed side slope

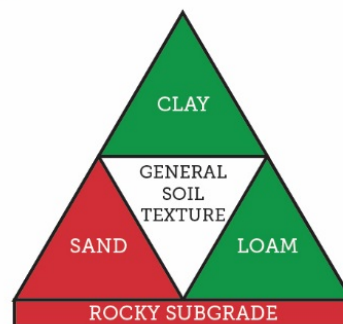
7. LIMITATIONS

- Not intended to be used as a standalone control measure. Will required a secondary erosion control measure.
- Only to be used as a temporary means of erosion control.
- Cannot be used on topsoil (spread out on the surface or in stockpiles) because of the compaction.
- Special care must be given to existing utilities around the area when performing roughening operations.

8. SOILS TRIANGLE

SOIL TEXTURE AND SUBGRADE CONDITIONS

- APPROPRIATE
- SOMEWHAT APPROPRIATE
- NOT APPROPRIATE



6. Surface Roughening and Vertical Tracking (SR)



9. SWMP ADMINISTRATOR FOR DESIGN CRITERIA

- Surface Roughening is recommended for all smooth graded slopes steeper than 5H:1V.
- Track walking texture must be parallel to the slope contour.
- Surface Roughening techniques may include:
 - **Machine Tracking** on cut or fill slopes in conjunction with grading operations by equipment heavy enough to texture the soil.
 - **Stair-step grading** on erodible material soft enough to be ripped with a bulldozer. Soft rock subgrades with subsoil are optimal for this technique.
 - **Grooving** on cut or fill slopes by tilling, disking, or harrowing, ensuring that grooves are less than 10 inches apart and at least 1 inch deep.

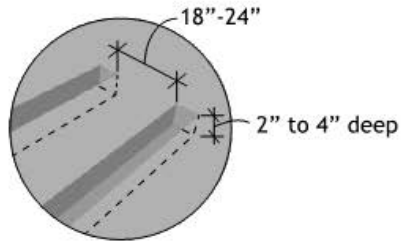
10. INSTALLATION CRITERIA

- Surface Roughening and Vertical Tracking must be provided on disturbed subsoils at the end of each day.
- Where topsoil is to be placed immediately after grading or where topsoil has already been placed, Surface Roughening or Vertical Tracking is **PROHIBITED**.
- Farming disks may not be used to provide surface roughening. It is preferred that ripping or tilling equipment be used along the contours.

11. MAINTENANCE AND REMOVAL

- Inspect site frequently, and before and after storm events, to ensure erosion or riling is not occurring within the small depressions created by tracking or roughening.
- Surface roughening is a temporary control measure and it may be necessary to continue to roughen the area multiple times until topsoil placement and permanent stabilization measures can be implemented.
- When revegetation is planned, subgrade preparation (ripping) is required prior to placing topsoil.

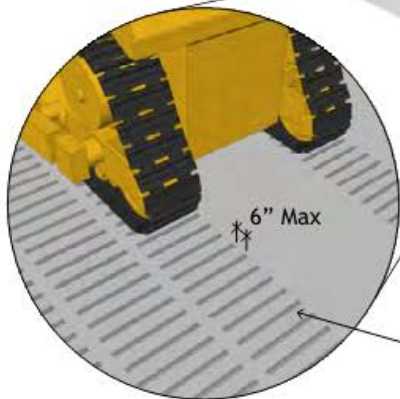
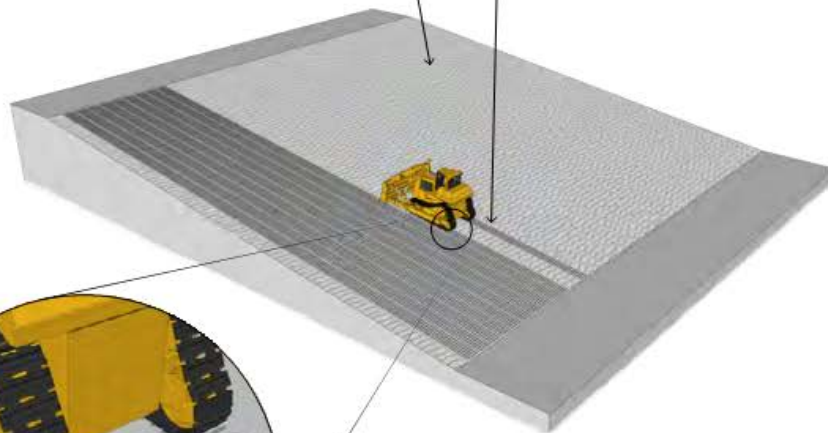
6. Surface Roughening and Vertical Tracking (SR)



DETAIL

Roughly graded slope

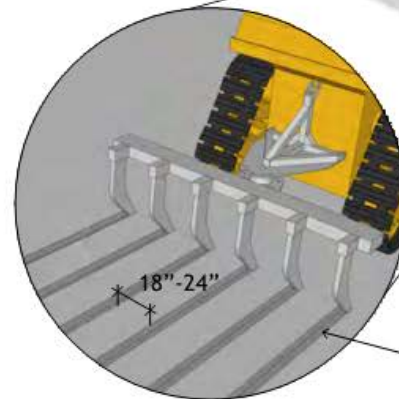
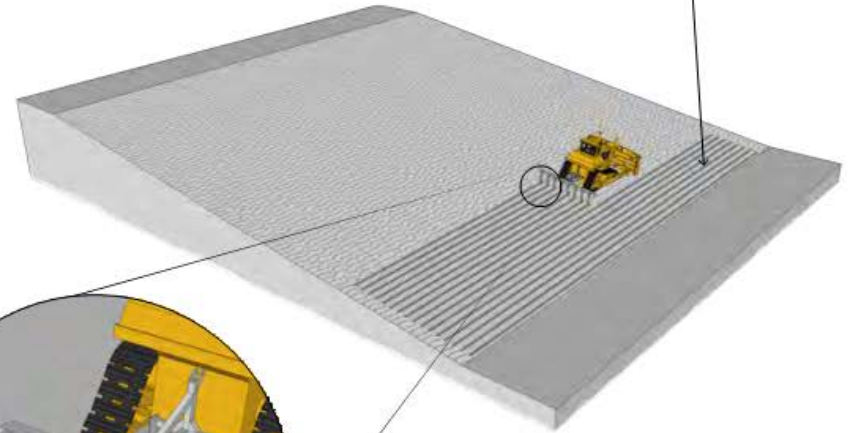
May use machine tracking, stair-step grading or grooving depending on soil conditions



SR - 1. VERTICAL TRACKING
FOR STEEP SLOPES (3:1 OR STEEPER)

Vertical tracks are spaced a maximum of 6 inches and can be up to 4 inches deep

May use machine tracking, stair-step grading or grooving depending on soil conditions



SR - 2. SURFACE ROUGHENING
FOR LOW SLOPES (LESS THAN 3:1)

Roughened rows are spaced a maximum of 6 inches and can be up to 4 inches deep

7. Seeding (TS)

1. DESCRIPTION:

This control measure practice involves the establishment of a permanent, perennial vegetative cover over areas disturbed during construction activities. The main goal of seeding is to stabilize the soil, reduce wind and water erosion, minimize sheet flow and rill erosion, increase infiltration rates, and reduce overall surface runoff.

2. CONTROL MEASURE OBJECTIVES

- Erosion Control
- Sediment Control
- Site/Materials Management

3. RELEVANT SPECIFICATION SECTIONS

[Section 212](#) - Seeding, Fertilizer, Soil Conditioner, and Sodding

[Section 207](#) - Topsoil

4. RELEVANT M-STANDARD DETAILS

Section not applicable for this control measure.

5. BASIS OF PAYMENT

Pay Item	Description	Pay Unit
212-00005	Seeding (Native)	LB
212-00006	Seeding (Native)	ACRE
212-00007	Seeding (Native)(Hydraulic)	ACRE
212-00009	Seeding (Temporary)	ACRE
212-00010	Seeding (Lawn)	LB
212-00011	Seeding (Lawn)	ACRE
212-00015	Seeding (Forbs)	LB
212-00020	Seeding (Forbs)	OZ
212-00022	Seeding (Riparian)	ACRE
212-00025	Seeding (Shrubs)	LB
212-00027	Seeding (Trees)	LB
212-00028	Seeding (Wetlands)	ACRE
212-00009	Seeding (Temporary)	ACRE



Drill Seeder Calibration

6. APPLICATIONS

- Used as part of the permanent stabilization steps for disturbed areas after construction activities are completed.
- Used only after topsoil has been dispersed on the site and soil conditioning amendments are applied.

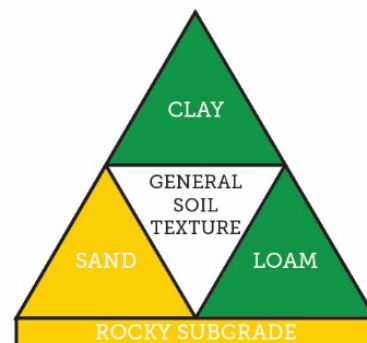
7. LIMITATIONS

- Permanent stabilization seeding can only be done in the approved seeding season windows for the different elevation ranges in Colorado.

8. SOILS TRIANGLE

SOIL TEXTURE AND SUBGRADE CONDITIONS

- APPROPRIATE
- SOMEWHAT APPROPRIATE
- NOT APPROPRIATE



This Control Measure may be appropriate for all soil types with the appropriate installation procedures for topsoil requirements, and other considerations as directed by the Transportation Erosion Control Supervisor or Regional Environmental Staff

7. Seeding (TS)



9. SWMP ADMINISTRATOR FOR DESIGN CRITERIA

- Soil surface preparation must be completed before application of seed.
- To select species for the permanent stabilization see mixes, the Designer should utilize the CDOT Landscape Architecture Section’s Native Seed Calculator, found at: <https://www.codot.gov/programs/environmental/news/native-seed-calculator>
- Topsoil management strategies must be included in the Stormwater Management Plan. These should include locations for the salvaged topsoil as either stock piles or windrow.
- Ground surface should not be compacted nor too loose.
- Temporary seeding consists of planting an annual grass.
- Drill seeding rates for temporary annual grasses are as follows:

Common Name	Botanical Name	Application Time	Seeding Rates (LBS PLS/acre)	Planting Depth (inches)
Oats	Avena sativa	October 1 - May 1	35	1 - 2
Foxtail Millet	Setaria italica	May 2 - September 30	30	1/2 - 3/4

- CDOT has created training videos demonstrating best field practices for landscape architecture pertaining to reclamation, revegetation, and stormwater management to help ensure compliance with CDOT Standard Specifications and CDPHE’s regulations for transportation projects. These videos include guidance for:
 - [Percent Vegetation Cover](#)
 - [Soil Preparation, Ripping and Tilling](#)
 - [Composting and Fertilizers](#)
 - [Drill Seeding Application Rate](#)
 - [Straw Mulching](#)
 - [Crimping and Tackifier](#)

For more information visit the Landscape Architecture Program web page at: <https://www.codot.gov/programs/environmental/landscape-architecture>

10. INSTALLATION CRITERIA

- Drill seeding is the most desirable method.
- Seeding seasons (Section 212.03) must be followed for native seeding.

11. MAINTENANCE AND REMOVAL

- Seeded areas require monitoring to ensure successful germination.
- Seeded areas require protection from vehicle and pedestrian traffic

2. Mulching, Agricultural Straw or Hay, and Mulch Tackifier (MU)



1. DESCRIPTION:

Mulching is a temporary control measure used for interim and permanent stabilization that consists of mechanically placing a uniform layer of agricultural straw or hay mulch that is crimped in and sprayed with tackifiers over disturbed construction areas. It protects disturbed areas immediately after seeding from the forces of rainfall impacts; it also increases infiltration. Mulching assists with germination success of seeded areas by conserving moisture and protecting against temperature extremes until permanent vegetation is established.



Straw Mulching on disturbed side slope

2. CONTROL MEASURE OBJECTIVES

- Erosion Control
- Sediment Control
- Site/Materials Management

3. RELEVANT SPECIFICATION SECTIONS

[Section 213](#) - Mulching

- a) [213.02.\(a\)/\(c\)/\(f\)](#) - Materials
- b) [213.03.\(a\)/\(d\)/\(g\)](#) - Construction Requirements
- c) [213.04](#) - Method of Measurement
- d) [213.05](#) - Basis of Payment

4. RELEVANT M-STANDARD DETAILS

Section not applicable for this control measure.

5. BASIS OF PAYMENT

Pay item	Description	Pay Unit
213-00002	Mulching (Weed Free Hay)	ACRE
213-00004	Mulching (Weed Free Straw)	ACRE
213-00061	Mulch Tackifier	LB

6. APPLICATIONS

- Use in conjunction with seeding to protect and stabilize disturbed soil.
- Use to cover disturbed areas for extended periods of time as a stabilization strategy.

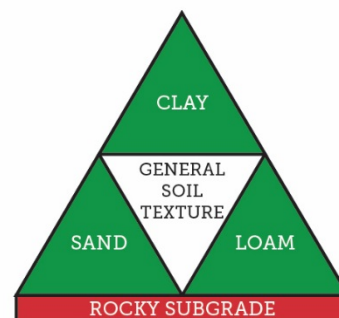
7. LIMITATIONS

- Material availability can impact feasibility of this control measure.
- Potential for introduction of weeds and other non-native plant materials.
- Potentially costlier due to increased labor requirements
- Permanent stabilization strategies for slope applications steeper than 2.5H:1V should consider Soil Retention Blanket or Mulching (Hydraulically applied)

8. SOILS TRIANGLE

SOIL TEXTURE AND SUBGRADE CONDITIONS

- APPROPRIATE
- SOMEWHAT APPROPRIATE
- NOT APPROPRIATE



2. Mulching, Agricultural Straw or Hay, and Mulch Tackifier (MU)



9. SWMP ADMINISTRATOR FOR DESIGN CRITERIA

- Tackifier must be used in conjunction with straw mulch in accordance with Section 213.02(c).
- Apply simultaneously or immediately after mulching and crimping to provide uniform coverage.
- Agricultural hay or straw should not be specified in concentrated flow areas either as interim or permanent stabilization. Hay and straw can also clog inlets and should not be used within water quality extended detention basins or sand filter structures.
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- Hay and straw can also clog inlets and should not be used within water quality extended detention basins or sand filter structures.

10. INSTALLATION CRITERIA

- Projects within Forest Service ROW or adjacent to sensitive areas might need special approval for the use of agricultural weed free straw or hay.
- Mulch materials should be air-dried and free of impurities in accordance with Section 213.
- For mulched areas to be seeded, native topsoil or approved equal (free of rocks, woody debris or soil clumps) shall be applied to disturbed areas in accordance with Section 207, or a Project Special Provision for Topsoil Management.
- Apply straw mulch at a rate of 1.5 to 2 tons per acre, in accordance with Section 213.
- Mechanically apply mulch at a depth of 1-2 inches. Hand application will require a thicker layer (2-3 inches, or as needed depending upon site conditions).
- Evenly distribute mulch over entire area, with at least 90% coverage.
- Apply mulch according to Section 213 using approved organic tackifier, crimping and anchoring within 4 hours.
- Do not place mulch on drainage channels, walls, sidewalks, pathways, or over existing vegetation.

11. MAINTENANCE AND REMOVAL

- Visually inspect at regular intervals and after every storm event to ensure mulch meets required coverage on all disturbed areas and slopes.
- Apply additional mulch as needed to meet the required soil coverage.
- Apply mulch tackifier with each additional mulching application.
- Manual inspection might be required to ensure appropriate adhesion has occurred.
- Mulching does not need to be removed as it will biodegrade with time.

APPENDIX D
Seed Mix

Seed Mix / Soil Amendments

The selected seed mix for the Location is the Loamy Plains Seed Mix that will be applied at the rate specified in the table below. All seed will be certified weed-free and pure live seed (PLS) rated per federal, state, county, and municipal standards.

Loamy Plains Seed Mix					
Common Name	Scientific Name	Variety	% of Seeds/square foot	Live seeds/square foot	lbs. PLS/Acre
Buffalograss	<i>Bouteloua dactyloides</i>	Cody or Bison	7%	4.03	3.1
Blue Grama	<i>Bouteloua gracilis</i>	Bad River or Birdseye	19%	11.25	0.59
Blue Grama	<i>Bouteloua gracilis</i>	Alma	4%	2.25	0.12
Russian Wildrye	<i>Psathyrostachys juncea</i>	Bozoisky Select	12%	6.83	1.7
Green Needlegrass	<i>Nasella viridula</i>	Lodorm	11%	6.3	1.52
Slender Wheatgrass	<i>Elymus trachycaulus</i>	San Luis or Revenue	16%	9.15	2.5
Western Wheatgrass	<i>Pascopyrum smithii</i>	Arriba	19%	11.25	4.46
Sand Dropseed	<i>Sporobolus cryptandrus</i>	Colorado origin if possible	12%	6.75	0.05
Total (Drill Rate)			100%	57.81	14.04

Note: The seed mix may be adjusted based on seed availability, seeding dates, or other variables.